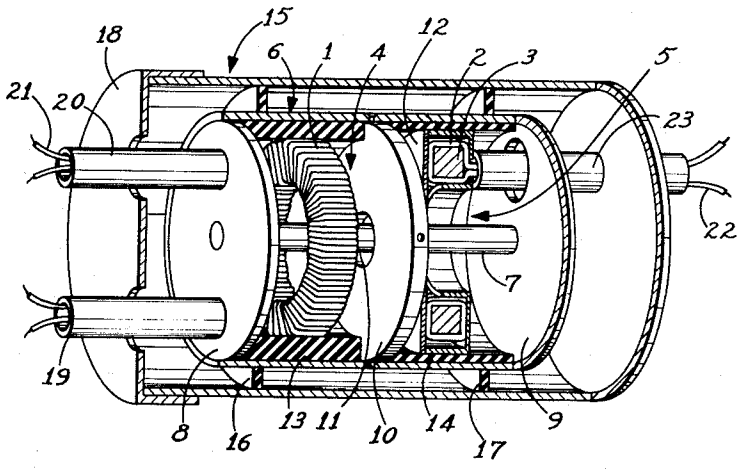
Feb. 6, 1962 J. F. GRAHAM 3,020,502

MULTICORE TRANSFORMER

Filed July 1, 1959




INVENTOR.
JOHN F. GRAHAM
BY Morris Moody
ATTORNEY
Glenn H. Antrim
AGENT

United States Patent Office 3,020,502 Patented Feb. 6, 1962



3,020,502

# MULTICORE TRANSFORMER

John F. Graham, Raytown, Mo., assignor to Collins Radio Company, Cedar Rapids, Iowa, a corporation of Iowa

Filed July 1, 1959, Ser. No. 824,260
8 Claims. (Cl. 336—73)

This invention pertains to multicore transformers, and particularly to shielding and coupling arrangements for multicore transformers having toroid coils.

Accordingly, the transformer of this invention comprises first and second toroid inductors mounted within separate compartments of an electrostatic shield, said shield having a central conductive member that passes through the central openings of said inductors and connects to opposite walls of said shield to complete a single-turn magnetic coupling link.

An object of this invention is to provide a high degree of capacitive shielding between adjacent coils in multicore transformers.

A further object is to provide a combination coupling link and a capacitive shield between adjacent toroid coils in a multicore transformer.

A feature of this invention is the compact arrangement for providing effective capacitive shielding in a toroid transformer.

The following description and the appended claims may be more readily understood with reference to the accompanying drawing wherein the single figure shows a partial sectional view of a two-core transformer.

The transformer in the accompanying figure which illustrates this invention comprises toroid coils or inductors **1** and **2** that are mounted within individual compartments **4** and **5** of a cylindrical enclosure **6**. Each of these coils is wound on a magnetic core such as core **3** shown for toroid coil **2**. The coils are magnetically coupled by a conducting member **7** which extends along the axis of the cylindrical enclosure or container **6** and is connected to the centers of the end pieces **8** and **9** of the enclosure. This enclosure has conductive walls and is divided into the two compartments **4** and **5** by centrally located conductive disc **10** which is secured to the cylindrical wall of the enclosure. A center hole **11** in disc **10** is of sufficient size to allow passage of conducting member **7** therethrough without direct electrical contact. Through this arrangement the coils are magnetically coupled by a single-turn coupling link that is completed through the center conducting member **7**, the ends and the walls of the cylindrical enclosure **6**. Disc **10** provides an electrical shield between the two coils.

In addition to the shield **10** for reducing capacitance between the two coils, a shield **12** of conductive material encloses the coil **2** and substantially extends through the window thereof. This shield may comprise a formed piece of metal as shown in the accompanying drawing, or a foil tape that is wound toroidally about the coil. The shield must be insulated in such a manner that short-circuit turns do not exist about the coil **2**. When foil is used for shielding, one side of the foil may have an insulating layer so that each turn of the shielding is insulated from each successive turn. In the accompanying figure the metal shield does not quite complete a full turn through the window of the coil **2**.

The toroids **1** and **2**, which are mounted coaxially within the respective compartments **4** and **5**, may be supported by insulating cylinders **13** and **14** respectively that fit tightly between the respective toroids and the inner cylindrical wall of enclosure **6**. Another practical means of mounting the coils within the enclosure is to position the coils and then fill the enclosure with an insulating sealing material. The enclosure **6** that provides shielding and



link coupling is mounted coaxially within a slightly larger conductive shielding enclosure **15** by a pair of insulating rings **16** and **17** that are disposed between the cylindrical walls of the two enclosures. If greater retaining force is required than is supplied by friction, mounting screws may be used to fasten the insulating rings to the cylindrical walls. Conventional insulated mounting posts may also be used for mounting the enclosure **6** within enclosure **15**. The enclosure **15** has a conductive cover **18**.

Shielding for insulated connecting leads **21** that connect to toroid coil **1** is provided by pieces **19** and **20** of conductive tubing which are electrically connected to one end of the inner enclosure **6** and extend through cover **18** of enclosure **15**. The shielding members **19** and **20** are insulated from cover **18**; the members may be insulated by passing them through insulating grommets (not shown) that are mounted to the cover. Conductive tubing **23** that extends through the other end **9** of enclosure **6** and through the adjacent end of enclosure **15** is provided for enclosing the insulated connecting leads **22** of the toroid **2**. The conductive tubing **23** is insulated from the inner enclosure but is connected to the end wall of the outer enclosure which would ordinarily be connected to ground.

Transformers constructed according to this invention are particularly useful in applications that require that the capacitance between the input windings and the output windings be maintained at a minimum. Shield **12** which is connected to ground and shielding partition **10** substantially eliminate capacitance between the separate coils. Since the capacitaance between the windings is substantially eliminated and the capacitance to ground is balanced, the impedances of different windings on the same core for different frequencies remain constant. In one application in a particular type of test equipment, toroid coil **1** contains two input windings that must remain balanced with respect to ground. The output is derived from toroid coil **2** which is enclosed by the shield **12** which is connected to ground. For application over the widest frequency range the individual windings obviously should be wound for the lowest distributed capacitance. Although this invention has been described with respect to a particular embodiment thereof, it is not to be so limited, as changes and modifications may be made therein which are within the spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. A multicore transformer having a combination electrostatic shield and a magnetic coupling member, first and second inductors, each of said inductors having a closed magnetic core with a central opening therethrough, said shield and coupling member comprising an enclosure having conductive walls, a shielding partition of conductive material disposed across said enclosure to divide said enclosure into first and second substantially enclosed compartments, said first and second inductors being mounted in said first and second compartments respectively, a central conductive member connected between opposite points on the inside wall of said container and passing through the openings of said first and second inductors and passing through but insulated from the central portion of said partition, whereby said central conductive member and the walls of said enclosure function as a single-turn link coupling between said inductors.

2. A multicore transformer as claimed in claim 1 having a second conductive enclosure that is larger than said first enclosure, insulating means for mounting said first enclosure within said second enclosure.

3. A multicore transformer as claimed in claim 1 having a second conductive shield insulated from said enclosure, said second shield substantially enclosing said second inductor.

4. A multicore transformer as claimed in claim 3 hav-

ing a second conductive enclosure that is larger than said first enclosure, insulating means for mounting said first enclosure within said second enclosure, and said second shield being insulated from said first enclosure and being connected to said second enclosure.

5. A multicore transformer having a combination electrostatic shield and a magnetic coupling member, first and second toroid coils wound on respective cores, said shield and coupling member comprising a cylindrical enclosure having conductive walls, a shielding partition of conductive material connected to said walls and disposed transverse the interior of said enclosure to divide said enclosure into first and second shielded cylindrical compartments, insulating means for mounting said first and second toroid inductors coaxially within said first and second compartments respectively, a conducting member extending along the axis of said enclosure through the windows of said first and second coils and through said partition, said conducting member being electrically connected to the end walls of said enclosure but being insulated from the point of passage through said partition, whereby said central conducting member and the walls of said enclosure provide a single-turn coupling link between said coils.

6. A multicore transformer as claimed in claim 5 having a second conductive shield insulated from said enclosure, said second shield substantially enclosing said second toroid coil and a portion of said second shield extending through the window of said second toroid coil and being insulated from other portions of said second shield as required to prevent any short-circuiting turns of the shield about the core thereof.

7. A multicore transformer as claimed in claim 5 having a second cylindrical conductive enclosure that is larger than said first enclosure, insulating means for mounting said first enclosure coaxially within said second enclosure.



8. A multicore transformer comprising first and second cylindrical enclosures, insulating means for mounting said first enclosure within said second enclosure, said enclosures having conductive walls and said first enclosure being a combination electrostatic shield and magnetic coupling member, a shielding partition of conductive material connected to the walls of said first enclosure and disposed transverse the interior of said first enclosure to divide said first enclosure into first and second shielding cylindrical compartments, first and second toroid coils wound on respective cores and mounted within said first and second compartments respectively, a conducting member connected between the end walls of said first enclosure and extending along the axis thereof through the windows of said first and second coils and through said partition, said conducting member being electrically connected to the end walls of said first enclosure but being insulated from the point of passage through said partition whereby said central conductive member and the walls of said first enclosure provided a single-turn coupling link between said coils, a second conductive shield substantially enclosing said second toroid coil, a portion of said second shield substantially extending through the window of said second toroid coil and being insulated from other portions of said second shield as required to prevent any short circuiting of turns of the shield about said second toroid coil, and said second shield being connected to said second enclosure but being insulated from said first enclosure.

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